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Use of electrospun fiber mats for the remediation of hypersaline geothermal brine

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ABSTRACT

Geothermal brines display high contents of various metal ions that can adversely affect surface and groundwater resources. Nevertheless, it is possible to sequestrate these metals and use some of them in certain engineering applications. The aim of this study was to fabricate electrospun chitosan fiber mats and remove heavy metal cations from geothermal brine of the Tuzla geothermal field (TGF) by employing these mats. TGF is located on the Biga Peninsula in the northwestern part of Turkey. The brine of TGF has high salinity (EC > 91 mS/cm) and high temperature (reservoir temperature is 173°C). The brine is rich in terms of metal cations. For instance, the concentration of lithium ion in geothermal fluid ranges from 17 to 35 mg/L, with little seasonal variations. A horizontal electrospinning setup was employed to obtain a non-woven mat comprising submicron diameter chitosan fibers at 2.0 kV·cm^{-1}. This material was then utilized as a stable membrane for the removal of metal ions present in the brine through sorption at 25°C overnight. The results showed that the chitosan fiber mats sequestrate various ions in the brine. Under the studied conditions, the material was capable of removing 46%, 44%, 50%, 44%, 40%, 67% and 48% of Li^+, Mg^{2+}, Ba^{2+}, Sr^{2+}, Mn^{2+}, Ca^{2+} and K^+ from the geothermal brine, respectively.

Keywords: Brine; Chitosan; Electrospinning; Geothermal fluid; Lithium

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